1. Scope

1.1 This procedure covers the steps involved in auditing gearbox design.

2. Referenced Documents

2.1 AGMA/AWEA 921-A97 Recommended Practices for Design and Specification of Gearboxes for Wind Turbine Generator Systems.

2.2 ANSI/AGMA 2101-C95 Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.

2.3 ANSI/AGMA 6001-D97 Design and Selection of Components for Enclosed Gear Drives.

2.4 ANSI/AGMA 6010-E88 Standard for Spur, Helical, Herringbone, and Bevel Enclosed Gears.

2.5 ANSI/AGMA 6023-A88 Design Manual for Enclosed Epicyclic Gear Drives.

2.6 ANSI/AFBMA Std 11-1990 Load Ratings and Fatigue Life for Roller Bearings.

2.7 GEARTECH Specifications:

| | | |
|---|---|---|
| CK1000 | QP1000 | Procurement process |
| CK2000 | QP2000 | Procurement specification |
| CK3000 | QP3000 | Bid solicitation and evaluation |
| CK4000 | QP4000 | Gearbox design audit |
| CK4100 | QP4100 | Gear design Audit |
| CK4200 | QP4200 | Bearing design audit |
| CK4300 | QP4300 | Shaft design audit |
| CK4400 | QP4400 | Housing design audit |
| CK4500 | QP4500 | Lubrication system audit |

3. Terminology

3.1 Gearbox design audit- The process of determining if the proposed gearbox and all of its components meet the requirements of the Procurement Specification.

4. Significance and Use

4.1 Significance and Use- A complete gearbox design audit including but not limited to gear detail drawings, assembly drawings and layout drawings is necessary to ensure the design meets the requirements of the procurement specification and has adequate capacity for the application.

5. Procedure

5.1. Proposal data- The proposal shall include all data listed in CK4000.

5.2 Gear Calculations- Gear calculations shall be performed per Section 4.3.1, of AGMA/AWEA 921-A97, Gear Life Rating, and QP4100.

5.3 Gearbox thermal rating- Gearbox thermal rating shall be performed per Section 4.3.2, of AGMA/AWEA 921-A97, Gearbox Thermal Rating, and QP4100.

5.4 Bearing calculations- Bearing calculations shall be performed per Section 4.3.3, of AGMA/AWEA 921-A97, Bearing Life Calculations, and QP4200.

5.5 Shaft Calculations- Shaft Calculations shall be performed per Section 4.3.4, of AGMA/AWEA 921-A97, Shaft Life Ratings, and QP4300.

5.6 Housing calculations- Housing calculations shall be performed as per Section 4.3.5, of AGMA/AWEA 921-A97, Housing, and QP4400.

5.7 Lubrication system- The lubrication system shall be audited for conformance to Section 4.8 of AGMA/AWEA 921-A97, Lubrication System, and QP4500.

5.8 Maintainability- The gearbox and lubrication system shall be audited for conformance to Annex E of AGMA/AWEA 921-A97, Operation and Maintenance, and the procurement specification.

6. Interpretation of Results

6.1 Specification conformance- The results of the gearbox design audit shall be compared to the requirements of the procurement specification for the following categories:

- Design features
- Load capacity
- Lubrication system
- Maintainability

7. Acceptance Criteria

7.1 Design features- Gearbox design features shall meet the requirements of AGMA/AWEA 921-A97 and the Procurement Specification.

7.2 Load capacity- Gearbox components shall have load capacities meeting the requirements of the following Quality Procedures:

QP4100 Gear design audit
QP4200 Bearing design audit
QP4300 Shaft design audit
QP4400 Housing design audit

7.3 Lubrication System- The lubrication system shall meet the requirements of QP4500.

7.4 Maintainability- Gearbox maintainability shall meet the requirements of AGMA/AWEA 921-A97 and the Procurement Specification.

7.5 Gearbox design audit- The gearbox design shall meet the requirements of the Procurement Specification.

8. Report

8.1 The report shall include the following:

8.1.1 Summary of gear life ratings and thermal ratings,

8.1.2 Summary of bearing life ratings,

8.1.3 Summary of shaft life ratings,

8.1.4 Summary of housing calculations,

8.1.5 Summary of lubrication system audit,

8.1.6 Summary of maintainability audit, and

8.1.7 Recommendations for revisions to engineering specifications required for conformance to the procurement specification.